A COMPARISON OF TWO MANDIBULAR DIMENSIONS IN *PEROMYSCUS*, WITH REGARD TO IDENTIFICATION OF PLEISTOCENE *PEROMYSCUS* FROM FLORIDA

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Abstract

Recent specimens of *Peromyscus polionotus, P. (Ochrotomys) nuttalli, P. gossypinus, P. floridanus, P. leucopus,* and *P. maniculatus* are compared with respect to two mandibular measurements; mandibular - alveolar (M.A.) length and ramus-alveolar (R.A.) length to aid in the identification of Florida Pleistocene *Peromyscus* mandibles. When each measurement is considered separately only *P. polionotus* and *P. floridanus* mandibles can be identified in part of their theoretical range of measurements. When the Florida species are considered with regard to the separate measurements, Student's t values are very high ($p<.001$ in all cases). The variance of each measurement is relatively low in all six species. When R.A. length is plotted against M.A. length for each specimen almost all Recent Florida *Peromyscus* mandibles can be identified to species. When *P. leucopus* and *P. floridanus* mandibles are added to this analysis *P. polionotus* and *P. floridanus* mandibles are still almost always identifiable, and *P. gossypinus* mandibles are still identifiable throughout much of their measured size range.

Introduction

The purpose of this paper is to present data that will aid in identifying Pleistocene species of *Peromyscus* from Florida, utilizing only mandibles, with or without the full complement of teeth. The data are also relevant to the identification of both Pleistocene and Recent *Peromyscus* species throughout the entire southeast and Gulf coastal United States. There is no intent here to present a complete study of southeastern *Peromyscus* mandibles, but merely to exhibit data which effectively separate the species. Other mandibular dimensions may prove just as satisfactory for this purpose.

All faunas mentioned in this paper without reference to locality or age are from the Florida Pleistocene.

Bader (1957) listed *Peromyscus* sp. from the Arredondo deposit. Later (1959) he presented comparisons of *P. floridanus, P. gossypinus,* and *P. polionotus* based on dental patterns. *P. (Ochrotomys) nuttalli* was mentioned once, as being distinguishable from *P. gossypinus* on qualitative grounds. Ray (1958) identified two left mandibles as *Peromyscus gossypinus* from the Melbourne locale, but listed no measurements other than gross size differences. Ray also stated that *P. gossypinus* could be distinguished from *P. nuttalli* on the basis of the scar configuration of the masseter muscles. Holman (1959) mentioned the presence of *P. gossypinus* in the Williston fauna, based upon measurements of the mandibular tooth row in very small samples of Recent *Peromyscus* from Florida. Gut and Ray (1963) listed all four of the extant Florida species of *Peromyscus* from the Reddick deposit, but no data were mentioned to substantiate the identifications.

Materials and Methods

Series of specimens of Recent *Peromyscus* were measured at the U.S. National Museum and the American Museum of Nat-

tural History. Young individuals, determined by pelage characters, skull suture patterns, and skin measurements were excluded (this usually included only those animals in which the M_3 had not erupted, or was in the process of erupting). Specimens with no tooth wear, but with adult tooth placement were measured. Sexual dimorphism was absent with regard to the two mandibular dimensions. Osgood (1909) showed that sexual dimorphism was negligible in *Peromyscus*.

The mandibular-alveolar length (M.A. length) was measured from the posterior lip of the last alveolus to the anterior lip of the first alveolus. Since the M_1 overhangs the first alveolus, the calipers were slanted either slightly medially or laterally to obtain a true alveolar measurement. The distance from the greatest angle of the posterior border of the ramus to the anterior border of the first alveolus (here termed ramus-alveolar, or R.A. length; see Fig. 1) was measured

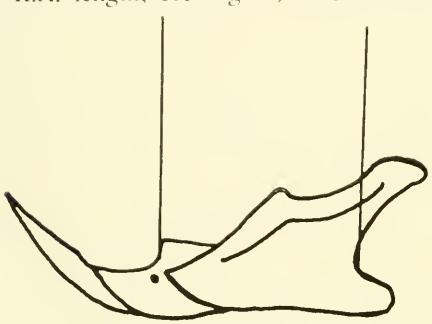

Figure 1. Determination of ramus-alveolar length. The area between the two lines indicates the ramus-alveolar (R.A.) measurement.

with the same modification as the M.A. length.

Measurements were taken with a Helios 7-inch calipers, calibrated to 1/20 mm. Formulae utilized for computations follow Simpson, Roe, and Lewontin (1960). Normal distribution is assumed in all calculations.

Results and Discussion

In Figures 2 and 3 we see that only *P. polionotus* and *P. floridanus* mandibles are adequately identifiable when each measurement is analyzed separately (only those specimens in a non-overlap range beyond $\pm 3s$ of the nearest species are considered identifiable).

The low values for the coefficient of variation (Table 1) indicate that the two characters studied are not highly variable within each species ("In mammals the C.V. for linear dimensions is usually between 4 and 10, occasionally between 3 and 4," Mayr, Linsley and Usinger, 1953).

Student's t values for the Florida *Peromyscus* species indicate that there is a significant difference between the species for both measurements ($p<.001$ in all cases). When R.A. length is plotted against M.A. length almost all Recent Florida *Peromyscus* mandibles are identifiable to species. (Fig. 4). Mandibles of *P. maniculatus* are not separable from those of *P. leucopus* by this method (Fig. 5), and the plotted distributions of these mandibles overlap much of the plotted distribution of *P. polionotus, P. nuttalli* and *P. gossypinus* (cf Figs. 4 and 5).

Peromyscus fossils from Florida consist principally of isolated teeth and mandibles, from which the teeth have usually been lost, making identification of the forms rather difficult. Ray (1958) pointed out that, "Records of the genus in the Pleistocene are highly unsatisfactory and certainly not indicative of true rarity." He included the cotton mouse, *P. gossypinus*, in the Melbourne fauna, and separated it from the other Florida species on the basis of gross size differences of the mandibles. *P. gossypinus* mandibles can probably be differentiated from

Table 1

The coefficient of variation (C.V.) and the number (N) of *Peromyscus* specimens studied for both mandibular dimensions.

	N	C.V. R.A. Length	C.V. M.A. Length
P. polionotus	50	3.97	4.18
P. leucopus	26	4.12	4.34
P. maniculatus	27	3.88	3.53
P. gossypinus	49	4.43	3.95
P. nuttalli	41	4.15	3.05
P. floridanus	34	4.42	4.56

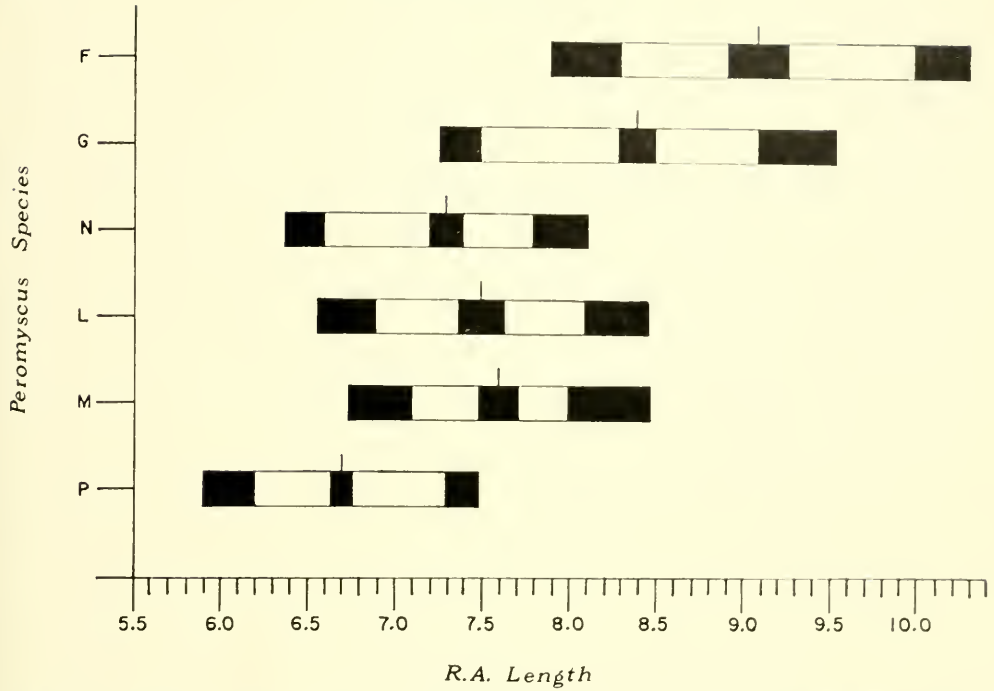

Figure 2. Graphic representation of the relationships of the 6 *Peromyscus* species studied for the R.A. length. The vertical line indicates the mean. The blackened portion of the bar in the immediate area of the mean represents the ± 95% confidence limits of the mean. The unshaded area plus the 95% confidence limits of the mean equals the observed range. The blackened end areas of the bar plus the preceding portions comprise ± 3s. The letters along the abcissa indicate the species: F= *P. floridanus*, G= *P. gossypinus*, N= *P. nuttalli*, L= *P. leucopus*, M= *P. maniculatus*, P= *P. polionotus*.

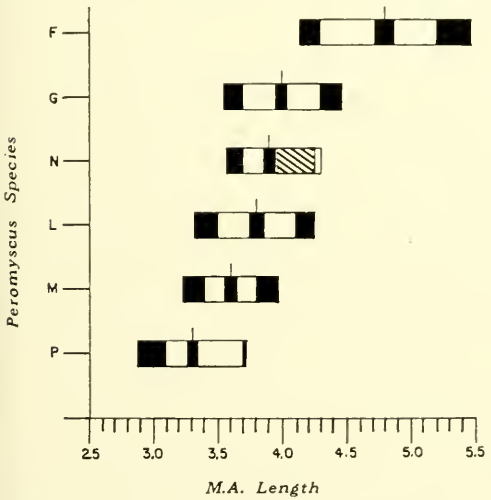

Figure 3. Graphic representation of the relationships of the 6 *Peromyscus* species studied for the M.A. length. Legend as in Fig. 2. The diagonal-lined portion of the bar for *P. nuttalli* (N) indicates the limits of + 3s. In *P. nuttalli* the observed range exceeds the range inclusive in + 3s.

those of *P. polionotus* and *P. floridanus* on gross size, but identifications should be supplemented by supporting measurement data. Although Ray (1958) mentioned that *P. nuttalli* mandibles could be separated from those of *P. gossypinus* on the scar configuration of M. Masseter profundus, pars anterior and M. Masseter medialis, pars anterior, I have not found this trait reliable, and Dr. Ray (pers. com.) has recently agreed that it is not a trustworthy character.

Holman (1959) identified *P. gossypinus* from the Williston deposit, and gave the mandibular tooth row measurements of his specimens as 3.8-4.4 mm. As I have not seen these specimens I must assume that they all possessed teeth. Therefore about 0.5 mm must be added to my measurements to convert them to a tooth row measure, since the M_1 slightly overhangs the first alveolus in specimens with teeth. Holman (1959) measured 10 specimens each of Recent *P. polionotus*, *P. gossypinus*, and *P.*

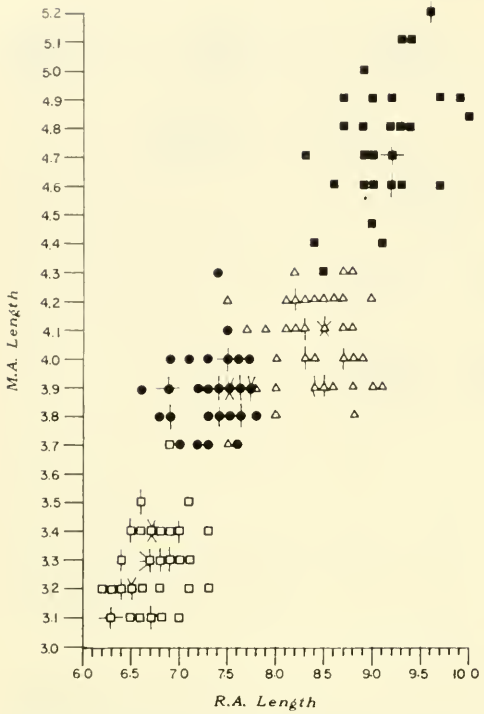

Figure 4. Scatter diagram showing the separation of all Florida *Peromyscus* mandibles when R.A. length (ordinate) is plotted against M.A. length (abcissa) for each individual. Each symbol without lines represents one individual. Where lines are associated with a symbol, they represent the number of individuals at that point. Light squares represent *P. polionotus.* Circles represent *P. nuttalli.* Triangles represent *P. gossypinus.* Dark squares represent *P. floridanus.*

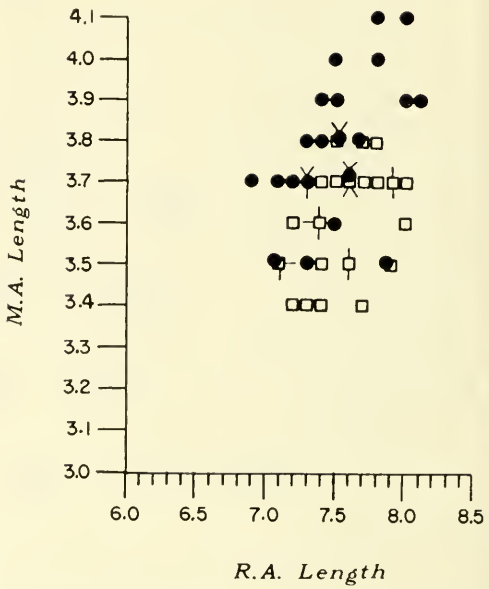

Figure 5. Scatter diagram showing the relationship of *P. leucopus* (circles) to *P. maniculatus* (squares) when R.A. length is plotted against M.A. length. Representation of individual specimens follows Figure 4.

floridanus, and only one specimen of *P. nuttalli* on which he based identification of his fossil forms. The ranges given are as follows: *P. polionotus;* 2.4-3.7 mm, *P. gossypinus;* 3.6-4.3 mm, *P. floridanus;* 4.4-5.0 mm, and *P. nuttalli;* 3.7 mm (cf with Fig. 3).

My measurements show that *P. gossypinus* mandibles cannot be distinguished on the basis of the M.A. length when either *P. leucopus* or *P. maniculatus* is presumed present. Referral of the Williston site to the Illinoian makes a Recent Florida *Peromyscus* aggregation unlikely at that time. As *P. gossypinus* is a derivative of *P. leucopus,* the fact that they hybridize in nature and produce fertile offspring when crossed in the lab (Dice, 1940; McCarley, 1954) indicates that they have not been isolated for very long. Their morphology, with the possible exception of hind-foot length, overlaps greatly (Dice, 1940; McCarley, 1954; and personal observation). Speciation of these forms could then be exclusively a Wisconsin or post-Wisconsin phenomenon. If, however, *P. gossypinus* was distinct from *P. leucopus* by Illinoian time, and the assumption is made that both *P. leucopus* and *P. maniculatus* were absent, a tooth row (or M.A.) measurement will not distinguish *P. gossypinus* from *P. nuttalli.* The tooth row length of 3.7 mm reported for *P. nuttalli* by Holman (1959) is the minimum limit of the M.A. observed range in this study.

Tamsitt (1957) compared mandibles of four *Peromyscus* species: *P. nasutus, P. boylii, P. pectoralis,* and *P. leucopus* in order to identify a number of *Peromyscus* mandibles from the late Pleistocene Friesenhahn fauna of Texas. He did not statistically compare his fossil or Recent material with *P. maniculatus,* also extant in Texas. He compared the four former species and the fossil forms with regard to seven mandibular dimensions, and his data show that no characters adequately separate any of the

species when each dimension is considered alone (without multivariate analysis). *Peromyscus nasutus* and *P. boylii* are generally smaller for all measurements than are *P. pectoralis* and *P. leucopus*, but measurements within the first and second pairs overlap each other in all cases, and both pairs may overlap for certain characters.

The fossil mandibles referred by Tamsitt (1957) to *"Peromyscus* cf. *leucopus"* are significantly larger than any *Peromyscus* analyzed in that paper (in four of the seven measurements there is a greater difference in the means between the fossil *P.* cf. *leucopus* and Recent *P. leucopus* than there is between *P. nasutus* and *P. leucopus*). The ranges of the alveolar length of the Recent *Peromyscus* studied by Tamsitt (1957) conform very closely to the ranges of *P. nuttalli, P. leucopus, P. gossypinus,* and *P. maniculatus* found in the present study. The range of the fossils however, demonstrates the presence of another *Peromyscus* species. Preliminary analysis of these fossils by myself indicates the presence of more than one *Peromyscus* species. The results will be reported at a later date.

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